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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/695,666	10/29/2003	Takatoshi Deguchi	032071	4071

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EXAMINER

BEREZNY, NEMA O

ART UNIT PAPER NUMBER

2813

DATE MAILED: 12/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/695,666

Applicant(s)

DEGUCHI, TAKATOSHI

Examiner

Nema O Berezny

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12, 13 and 15-18 is/are rejected.
- 7) ☒ Claim(s) 11 and 14 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 02022004.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION

Claims 1-18 are currently pending.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

Claim Objections

Claim 2 is objected to because of the following informalities: at line 8, delete "plain" and insert --plane-- thereto. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8, 11, and 14 recite the limitation "the third hard mask" in lines 4-5, 4, and 4, respectively. There is insufficient antecedent basis for this limitation in the claim.

Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 3 requires "the first to the third hard mask are made from one kind of inorganic material," but claim 2 from which claim 3 depends requires

that "the second hard mask is made from a different material from the first and the third hard mask." Correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5 are rejected under 35 U.S.C. 102(e) as being anticipated by Huang et al. (2003/0119305). Huang discloses a method for manufacturing a semiconductor device for forming a wiring by a dual damascene method, the method comprising the steps of: forming a mask (Figs.15-26 el.58,59,60) for a wiring trench on an interlayer dielectric film (Fig.23 el.51,52); forming a mask for a via hole on the mask for the wiring trench by using a multilayered resist (Fig.16 el.62,61); forming a hole shallower than a thickness of the interlayer dielectric film in the interlayer dielectric film by processing the interlayer dielectric film, using the mask for the via hole (Fig.21); forming a wiring trench in the interlayer dielectric film by processing the interlayer dielectric film, using the mask for the wiring trench, and simultaneously forming a via hole by passing the hole through a base layer (Figs.23-24); and embedding a wiring material (el.66) in the wiring trench and said via hole [**claim 1**]. Huang also discloses wherein said step of forming the

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mask for the wiring trench includes the steps of: forming a first (el.58), a second (el.59), and a third (el.60) hard mask in this order on the interlayer dielectric film; and processing the third hard mask so as to be a plane shape to the wiring trench (Fig.26), and wherein the second hard mask is made from a different material from the first and the third hard mask (p.3 para.33) **[claim 2]**; wherein the first to the third hard mask are made from one kind of inorganic material selected from the group consisting of silicon nitride: silicon dioxide, silicon carbide, amorphous hydrogenated silicon carbide, silicon carbide nitride, organo-silicate glass, silicon rich oxide, tetraethylorthosilicate glass, phosphosilicate glass, organic siloxane polymer, carbon doped silicate glass, hydrogen doped silicate glass, silsesquioxane glass, spin-on glass, and fluorinated silicate glass (p.3 para.33) **[claim 3]**; wherein the first hard mask is between 30 nm and 100 nm thick; the second hard mask is between 50 nm and 200 nm thick; and the third hard mask is between 30 nm and 100 nm thick (p.3 para.32) **[claim 4]**; and wherein the interlayer dielectric film is made from an organic material (p.3 para.29) **[claim 5]**.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 6-10, 12-13, 15, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang as applied to claim 1 above, and further in view of Takase et

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al. (6,051,508). Huang does not disclose a mask for the via hole comprising an organic film, an inorganic film, and a photoresist layer on the wiring trench mask. However, Huang would look to one such as Takase for self-planarization because Takase discloses wherein said step of forming the mask for the via hole includes a step of forming an organic film (Fig.3D el.27), an inorganic film or spin-on glass film (el.29), and a photoresist layer (30) in this order on the mask for the wiring trench (col.8 lines 4-16). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the layers of Takase with the method of Huang since organosiloxane and SOG don't need a separate planarization step (Takase – col.5 lines 8-12, 21-23) **[claims 6, 7]**.

Based upon the rejection of claim 6 above, Takase also discloses wherein a thickness of the inorganic film is thinner than a total film thickness from the first to the third hard mask (col.8 lines 4-10). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thickness of layers of Takase with the method of Huang. Since the mask serves as a barrier, adequate thickness is necessary (p.3 para.32) **[claim 8]**.

Takase also discloses wherein the organic film is between 100 nm and 400 nm thick (col.8 lines 4-5); the inorganic film is between 30 nm and 200 nm thick (col.8 lines 6-7); and the photoresist layer is between 100 nm and 300 nm thick, supposing the interlayer dielectric film is between 100 nm and 600 nm thick (col.7 lines 27-31). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thickness of layers of Takase with the method of Huang. An

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interlayer dielectric film separates wiring layers and therefore needs to be a larger thickness **[claim 9]**.

Takase also discloses wherein said step of forming the mask for the via hole includes the steps of: processing the photoresist layer so as to be a plane shape to the via hole; processing the inorganic film so as to be a plane shape to the via hole by using the photoresist layer as a mask, and processing the organic film so as to be a plane shape to the via hole by using the inorganic film as a mask (Fig.3D); and simultaneously removing the photoresist layer (Figs.3E-3F). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the processing steps of Takase with the method of Huang. A second photoresist layer for a mask would not be necessary by using the inorganic layer as a mask **[claims 10, 13]**.

Takase also discloses wherein said step of forming the mask for the via hole includes a step of forming an organic film (el.27) and a photoresist layer (el.30) containing Si in this order on the mask for the wiring trench (col.8 line 4). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the films of Takase with the method of Huang since organosiloxane and SOG don't need a separate planarization step (Takase – col.5 lines 8-12, 21-23) **[claim 12]**.

Takase also discloses wherein a thickness of the organic film is thinner than that of the interlayer dielectric film (col.7 lines 27-31; col.8 lines 4-5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to

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use the thicknesses of Takase with the method of Huang. An interlayer dielectric film separates wiring layers and therefore needs to be a larger thickness [**claims 15, 17**].

Claims 16 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang in view of Takase as applied to claims 1, 6, and 12 above, and further in view of Pan et al. (2004/0023497). Huang in view Takase do not disclose a film exposed at a wavelength of 248, 193, or 157 nm. However, Huang and Takase would look to one such as Pan for small patterning dimensions because Pan discloses wherein a film exposed by light at a wavelength of 248 nm, 193 nm, or 157 nm is formed as the photoresist layer (p.1 para.5). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the exposure wavelengths of Pan with the method of Huang and Takase because smaller patterning dimensions can be achieved at these wavelengths (Pan – p.1 para.5).

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter for claims 11 and 14: the prior art of record does not teach or disclose or make obvious a method for manufacturing a semiconductor device according to claims 1, 6, and 10, and claims 12-13, respectively comprising inter alia: simultaneously removing the inorganic film while processing the first to third hard masks to form a plane shape to the via hole; or simultaneously removing the photoresist film while processing the first to third hard masks to form a plane shape to the via hole.

Claims 11 and 14 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

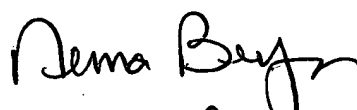
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O Berezny whose telephone number is (571) 272-1686. The examiner can normally be reached on M-F 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB


Nema Berezny